Chapter 6: Survival Equipment and Pyrotechnics

Overview

Introduction

The danger of falling overboard, capsizing, or sinking is always present. Few people can stay alive for long in the water without some type of survival equipment. Fear, fatigue, and exposure are the enemies of water survival. The desire to live, think clearly, and proficiently use available equipment make the difference between life and death. The boat coxswain has overall responsibility for the safety of the boat and crew — that all required safety equipment is on board, readily accessible, in working condition, and its use and operation understood by all. However, each boat crew member has the personal responsibility to stay alert and knowledgeable in these matters. This chapter addresses the characteristics and use of survival gear and signaling devices, including pyrotechnics.

NOTE

For specific policies, guidance, and technical information concerning configuration, application, stowage, and maintenance of survival equipment discussed in this chapter, refer to the *Coast Guard Rescue and Survival Systems Manual*, COMDTINST M10470.10 (series).

In this chapter

These items are discussed in this chapter:

Section A. Personal Flotation Device (PFD)

Overview

Introduction

The term "**personal flotation device" (PFD)** is a general name for the various types of devices designed to keep you afloat in water. PFDs include life preservers, vests, cushions, rings, and other throwable items. They are available in five different types: Type I, II, III, IV and V. Each type of PFD provides a certain amount of flotation.

NOTE

A wearable PFD can save you're life, but only if you wear it.

Regardless of the type, all PFDs must be Coast Guard approved, meaning they comply with Coast Guard specifications and regulations relating to performance, construction, and materials. A usable PFD is labeled Coast Guard approved, in good serviceable condition, and of appropriate size for the intended user. Each boat crew member must wear a usable PFD and signal kit.

In this section

This section contains the following information:

Type I PFD

A.1 General

The **Type I PFD**, or "off-shore life jacket," is a one-piece, reversible PFD intended primarily for use by survivors, passengers on towed vessels, or prisoners aboard vessels. A Type I PFD provides an unconscious person the greatest chance of survival in the water. The Type I PFD is the only wearable device required to be reversible. It comes in two sizes, an adult size (90 pounds and over) which provides at least 20 pounds of buoyancy and a child size (less than 90 pounds) which provides at least 11 pounds of buoyancy, and must be international orange in color.

A.2. Advantages

Type 1 PFD is effective for all waters, especially open, rough, or remote waters where rescue may be delayed. It is designed to turn most unconscious wearers in the water from a face-down position to a vertical or slightly backward position, allowing the wearer to maintain that position and providing **at least 20 pounds** of buoyancy. This buoyancy will allow you to relax and save energy while in the water, thus extending your survival time.

A.3. Disadvantages

There are three major disadvantages to this type of PFD:

- Bulky and it restricts movement.
- Its buoyancy restricts the underwater swimming ability you may need to escape from a capsized boat or to avoid burning oil or other hazards on the surface of the water.
- Minimal protection against hypothermia.

NOTE

This type of PFD is <u>not</u> recommended for use by boat crews because it restricts mobility.

A.4. Donning

Before entering the water, don and adjust a Type I PFD using the following steps:

Step	Procedure
1	Grasp the PFD at the lower part of head opening and pull outward to expand opening.
2	Slip your head through opening.
3	Pass the body strap around your back and fasten at the front of the PFD, then adjust the strap for a snug fit.

WARNING

For safety, always tuck all loose straps into your pockets, shirt, or belt. Adjust straps on injured people <u>before</u> they are lowered into the water.

A.5. Entering the water

Use the following procedures to enter the water.

NOTE

Follow these steps before entering the water wearing any type of PFD or combination of cold weather protective device (e.g., dry suit) and PFD.

Step	Procedure
1	Ensure all straps on the PFD are securely fastened, tightened to a snug fit, and tucked in to prevent them from snagging.
2	Stand on the boat's gunwale, on the windward side, at a point closest to the water.
3	Fold your arms across your chest and grip the PFD with your fingers. This will prevent the PFD from riding-up and striking your chin or neck.
4	Keep your body erect and legs held together and crossed when entering the water. It is better to gently slip in, if possible, rather than jumping.
5	If you must jump into water with chemicals, oil, or burning oil on the surface, place one hand over your mouth with the palm under your chin and split fingers tightly squeezing your nostrils shut. Place your other hand on the PFD collar to keep it in place.

Type II PFD

A.6. General

The **Type II PFD**, also known as a "near-shore buoyant vest," is a wearable device that will turn some unconscious wearers to a face-up position in the water. It comes in different colors and in three categories:

- adult (more than 90 pounds) which provides at least 15.5 pounds of buoyancy;
- child, medium (50 to 90 pounds) which provides at least 11 pounds of buoyancy ; and
- infant (available in two sizes, less than 50 pounds and less than 30 pounds) which provides at least 7 pounds of buoyancy.

A.7. Advantages

This type is usually more comfortable to wear than the Type I. It is usually the preferred PFD if there is a chance of a quick rescue, such as when other boats or people are nearby.

A.8. Disadvantages

The turning characteristic of the Type II is not as strong as with a Type I because of a lesser amount of flotation material, and therefore, under similar conditions, will not be as effective in turning a person to a face-up position.

A.9. Donning

Before entering the water, don and adjust a Type II PFD using the following steps:

Step	Procedure
1	Grasp the PFD at the lower part of head opening and pull outward to expand opening.
2	Slip your head through opening.
3	Pass the body strap around your back and fasten at the front of the PFD, then adjust the strap for a snug fit.
4	Secure the chest tie with a bow knot for a snug fit.

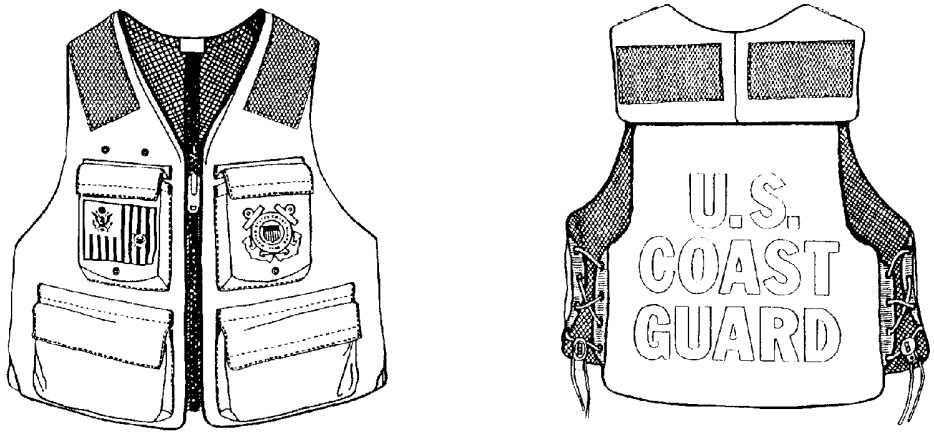
A.10. Entering the water

To enter the water while wearing a Type II PFD, follow the instructions in paragraph A.5. above.

Type III PFD

A.11. General

The **Type III PFD**, also known as a "flotation aid," is routinely worn aboard boats when freedom of movement is required, the risk of falling over the side is minimal, and the water temperature is greater than 15°C/60°F. It is **not designed** to turn an unconscious wearer to a face-up position; the design is such that conscious wearers can place themselves in a vertical or slightly backward position. It has a minimum of **15.5 pounds** of buoyancy and comes in many sizes and colors. Figure 6-1 shows the Type III PFD vest that boat crews are authorized to wear. Most approved flotation coats ("float coats") are also Type III PFDs.



Type III PFD Vest
Figure 6-1

A.12. Advantages

Type III PFD offers boat crew members greater comfort and freedom of movement. It is designed so **wearers can place themselves** in a face-up position in the water. The Type III PFD allows greater wearing comfort and is particularly useful when water skiing, sailing, hunting from a boat, or other water activities.

A.13. Disadvantages

There are some disadvantages in the Type III PFD:

- Flotation characteristics are marginal and not suitable for wear in heavy seas
- Tendency to ride-up on the wearer in the water

- Wearer may have to tilt head back to avoid a face-down position in the water
- While the Type III has the same amount of buoyancy material as the Type II PFD, the distribution of the flotation material in a Type III reduces or eliminates the turning ability.

WARNING

The Type III PFD will not provide an adequate level of buoyancy when worn with a full complement of law enforcement gear. If unable to remain afloat, jettison easily accessible equipment.

A.14. Donning

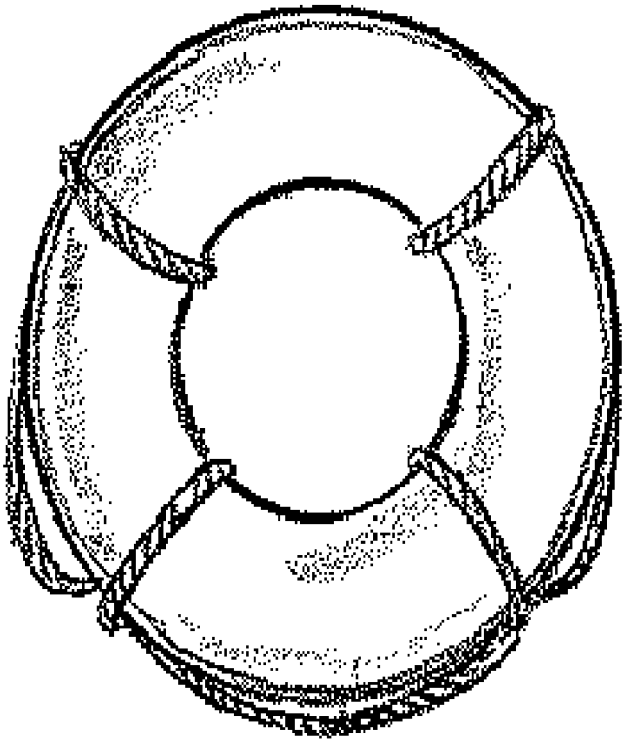
Before entering the water, don and adjust a Type III PFD using the following steps:

Step	Procedure
1	Place your arms through the openings in the vest.
2	Close zipper, if provided. Close front slide fasteners.
3	Adjust waist straps for a snug fit.

Type IV PFD

A.15. General

The Type IV PFD is a Coast Guard approved device that is thrown to a person in the water and is grasped by the user until rescued. The most common Type IV devices are buoyant cushions and ring buoys. Buoyant cushions come in many different colors. Ring buoys must be white or orange in color. One of the disadvantages of the Type IV PFD is that it is not worn, although some can be secured to the body once reached in the water.



Life Ring
Figure 6-2

Type V PFD

A.16. General

Type V PFDs are also known as "Special Use Devices." They are intended for specific activities and may be carried instead of another PFD **only if used according to the approval condition on the label**. For example, a Type V PFD designed for use during commercial white-water rafting will only be acceptable during commercial rafting; it is not acceptable for other activities unless specified on the label. Examples of Type V PFDs are: the Coast Guard work vest with unicellular foam pads, sailboard PFDs with harness, "thermal protective" PFDs (deck suits/exposure suits), and hybrid inflatable PFDs.

A.17. Hypothermia protection

Some Type V devices provide significant hypothermia protection. Please refer to Section C. for more information on the antiexposure coverall.

PFD Storage and Care

A.18. Storage	Despite the mildew inhibitor treatment required for PFDs, stowing them in moist, damp lockers will increase deterioration of the fabric because of mildew. Remember, heat, moisture, and sunlight will increase the deterioration of the parts of PFDs. Therefore, store PFDs in a cool, dry place out of direct sunlight. A "dry" area is considered any suitable area where water will not condense on a PFD. All PFDs should be kept away from oil, paint, and greasy substances. Remember, more important than their storage condition is that they are readily accessible. The Coast Guard does not consider any PFD "readily accessible" if it is kept in its original wrapper. Persons under stress may be unable to get them out promptly. Also, the wrapper can trap moisture leading to mildew and rot.
A.19. Care	If a PFD requires cleaning, wash it in fresh, warm water with a mild detergent. Then rinse the PFD in clean, fresh water.

PFD Survival Equipment

A.20. General

PFD survival equipment is attached to a PFD to provide a means of signaling a position from the surface of the water using sight and sound signals.

A.21. Standard outfitting

All PFDs in service shall be outfitted with two accessories:

- Whistle secured to the PFD with a lanyard
- Distress signal light (battery operated strobe light OR the Personnel Marker Light (PML) chemical light) secured to the PFD.

The requirement for a whistle and a distress signal light may be waived if the PFD is worn in conjunction with the Boat Crew Signal Kit.

NOTE

Auxiliary PFD survival equipment requirements are in the *Auxiliary Operations Policy Manual*, COMDTINST M16798.3 (series).

A.22. Personnel Marker Light (PML)

A PML is a device that uses either battery or chemical action to provide light for the wearer to be seen during darkness. The yellow-green light of a PML is visible for a distance of approximately one mile on a clear night and lasts as long as eight hours. It is the only chemical light approved for use as a distress signal light on a PFD. A certified PML complies with regulation 46 CFR 161.012 (Coast Guard approved). Large marine supply houses carry Coast Guard approved PMLs. They are specifically designed to be attached to a PFD without damaging or interfering with the PFD's performance. The PML's hard plastic sleeve protects the glass ampules inside the tube from breakage and deterioration from the effects of light. There are three steps needed to activate the PML:

Step	Procedure
1	Squeeze the handle to break the glass vials of activating chemical compounds suspended inside the tube.
2	Remove the black sleeve.
3	Squeeze the handle again if the PML does not light.

CAUTION !

The PML replaces only the distress signal light that is required to be attached to all PFDs in service. It does not replace the distress signal light (SDU-5/E or CG-1 strobe) that boat crew members are required to carry in their boat crew signal kit.

CAUTION !

There is a seal at one end of the PML which holds the protective sleeve in place. If this seal is broken, replace the PML immediately.

The intensity of the PML's light signal in cold weather (below 0°C/32°F) is reduced. In colder temperatures, the light will last longer, but will not have the same brilliance as in warmer conditions. Units that consistently operate in temperatures below 0°C/32°F shall use distress signal lights in place of PMLs.

NOTE

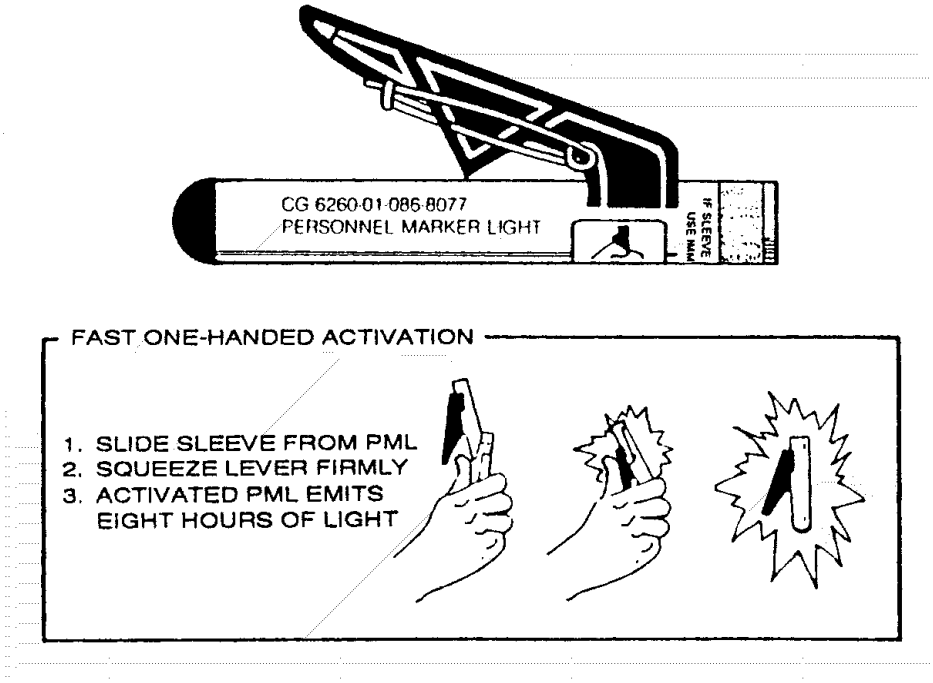
Most batteries or chemicals have a useful shelf life of about two years. Therefore, check PMLs for the expiration date (located somewhere on the device) to find out when replacement is in order.

NOTE

The time period a chemical light provides effective illumination depends upon its age and the temperature. A recently purchased light stick used in 21-27°C/70-80°F temperatures (ideal conditions) will provide 8 to 12 hours of light. As the device gets older, its effective period is considerably less.

A.23. Retroreflective material

The Coast Guard attaches retroreflective material on all PFDs for better visibility in the dark. All Auxiliarists are required to use retroreflective material on their PFDs. It is a very simple, but effective, addition to the safety effort. Use a Coast Guard approved reflective material. Instructions for applying this are usually found on the retroreflective material packaging.



Personnel Marker Light (PML)
Figure 6-3

Standard Navy Preserver

A.24. General characteristics

The Standard Navy Preserver, although not Coast Guard approved, is a common PFD used by the naval services. This preserver is one of the best devices for keeping a person afloat; however, its major drawback is that it requires training to become familiar with the many straps and fastenings used to don this device quickly and properly. Consequently, the Standard Navy Preserver is not Coast Guard approved for civilian use. Any Auxiliarist who plans to go aboard a Coast Guard boat or cutter as crew (or passenger) should request instructions in the donning of this PFD.

Section B. Hypothermia Protective Clothing

Overview

Introduction

Accidentally falling into cold water has two potentially lethal consequences: drowning or hypothermia. Previously, we discussed the protection provided by PFDs against drowning. The Coast Guard requires active duty Coast Guard and Auxiliary crews to wear hypothermia protective clothing in heavy weather or hazardous operating conditions (water temperature below 15°C/60°F) .The operational commander may waive this requirement, but only on a case-by-case basis.

Hypothermia protective clothing is designed to permit you to function in cold weather and water conditions. There are four primary types used by the Coast Guard:

- Antiexposure Coverall
- Dry Suit
- Wet Suit (surface swimmers only)
- Survival (Exposure) Suit

NOTE

A special type float coat, with a Type V-approval label, meets the same flotation requirements as the antiexposure coverall, but provides only partial covering and less thermal protection.

The survival (exposure) suit will not be discussed since it is limited to use for crews operating in cold water when abandoning ship because it is extremely bulky and awkward to work in.

A local Coast Guard unit or district may purchase the Coast Guard's antiexposure coverall, survival, and wet suits and lend them to the Auxiliary. The descriptive information below is for those who wish to purchase their own suits.

NOTE

Hypothermia protective clothing shall be worn by boat crew members when the water temperature is below 15°C/60°F.

In this section

This section contains the following information**.**

Requirements

B.1. General

The unit commander may waive the requirement for hypothermia protective clothing for boat crew members on a case by case basis **when the degree of risk to exposure and hypothermia is minimal** (e.g., non-hazardous daylight operations in calm water). When a waiver is granted, hypothermia protective clothing must be carried on the boat. **Coxswains shall require boat crew members to don proper hypothermia protective clothing during heavy weather or hazardous operations (e.g., recovery of a person from the water or helicopter operations).** Unit commanders are responsible for the enforcement of this policy for Auxiliary facilities under their operational control. If an Auxiliary facility is granted a waiver, it is not required to carry protective clothing aboard.

NOTE

Timely rescue is a high priority when victims are in the water. When the boat has prior knowledge of a victim in the water, the surface swimmer, if available, will don a dry or wet suit and swimmer's safety harness before entering the water. Coxswains of boats operating in water temperatures that dictate the use of a dry or wet suit shall ensure that the surface swimmer is correctly outfitted.

B.2. Proper clothing

The best way to avoid cold related injuries is to wear proper clothing. When choosing clothing combinations, the best advice is to layer clothing. As the work effort changes or when an article of clothing becomes damp, the number of layers can be adjusted for comfort.

CAUTION !

More layers of clothing reduce maneuverability which can be dangerous for boat crew members. Also, remember to wear insulated socks and boots (with reinforced toe), hoods, face masks, goggles and gloves as required to protect yourself against the elements (see Chapter 5, Crew Efficiency Factors).

B.3. Maintaining body heat

Wet clothing robs the body of heat by breaking down the thermal protection of insulated clothing. It is extremely important to replace wet clothing as soon as possible to prevent cold related injuries, particularly if the person is idle after a period of heavy perspiring. Many cold weather medical problems involve wet hands and feet. These areas should receive special care.

B.4. Wearing a PFD	Boat crew members shall wear a PFD at all times with the dry suit. Crew members should not wear a PFD over an antiexposure coverall. (A wet suit is not authorized for use by boat crew members - it may be worn by a surface swimmer.)
B.5. Distress signal devices	Boat crew members shall wear the contents of the boat crew signal kit (discussed later in this Chapter) tethered to the hypothermia protective device when worn. Surface swimmers wearing a dry suit or a wet suit may carry a distress signal light and a signal whistle in lieu of the contents of the boat crew signal kit. Wearing a PML is recommended for boat crew members and the surface swimmer.

Antiexposure Coverall

B.6. General

Antiexposure coveralls are Type V PFD. The antiexposure coverall is the standard garment for cold weather operations with closed cockpit boats (see Figure 6-4).It provides good durability and out-of-water protection from the elements but limited protection from hypothermia in the water.

B.7. Characteristics

Antiexposure coveralls are constructed with a fabric cover and a closed cell foam lining. These suits provide a full range of movement and come in a variety of sizes. They provide adequate mobility and protection from limited exposure to outside elements such as wind and spray. The flotation characteristics of the coverall are similar to those of the Type III PFD. The approved coveralls feature an orally inflated pillow for a better flotation angle for extended periods of exposure.

B.8. Use

Antiexposure coveralls provide hypothermia protection when the wearer is **only periodically exposed** to conditions which cause hypothermia. When more than periodic exposure is anticipated, even on boats with closed cockpits, a dry suit should be worn.

CAUTION !

When wearing this type of suit, it is important to tighten all closures and adjustments before entering the water. A loose-fitting suit may allow too much water in and greatly reduce the thermal effectiveness of the suit leading to hypothermia.

WARNING

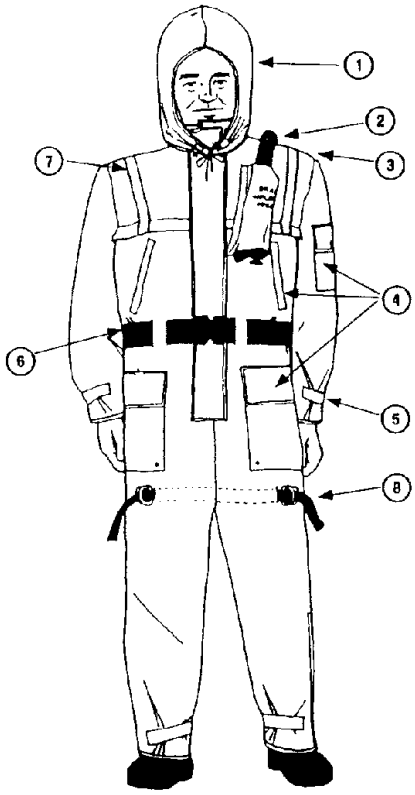
Wearing a type I or III PFD over an antiexposure coverall may be dangerous in certain situations. The additional buoyancy may restrict the wearer's ability to swim out from under a capsized boat. In extreme situations, where buoyancy is a limitation instead of an advantage, you may need to remove your PFD.

B.9. Donning

Antiexposure coveralls are designed to be worn over your uniform in the same manner as standard coveralls. For added protection, wear polypropylene thermal underwear as a moisture wicking layer next to the skin. Also use insulated socks and boots (with reinforced toe), hoods, face masks, goggles and gloves to protect against the elements.

B.10. Entering the water Before entering the water with antiexposure coveralls, follow these steps:

Step	Procedure
1	Ensure the zipper is completely closed.
2	Tighten straps at the neck, waist, thigh, and ankle to reduce transfer of cold water inside the suit. This increases the degree of hypothermia protection.
3	Orally inflate the pillow behind the collar. This will provide support for your head.



1. LINED HOOD
2. ORAL INFLATION TUBE
3. INFLATABLE HOOD
4. POCKETS
5. WRIST CLOSURES
6. ADJUSTABLE BELT
7. RETRO-REFLECTIVE TAPE
8. LEG STRAPS

Antiexposure Coverall
Figure 6-4

Dry Suit

B.11. General

The **dry suit** shall be worn when operating open cockpit boats when the water temperature is below 10°C/50°F and the air temperature is below 7°C/45°F. It provides protection in areas where exposure to wind, spray, cold water, and hypothermia is likely (see Figure 6-5). The dry suit, with proper undergarments, provides the best protection for crew members in adverse weather and cold water immersion.

WARNING

Dry suits provide no inherent buoyancy. A PFD must be worn over a dry suit at all times while underway.

B.12. Characteristics

Dry suits are constructed of a trilaminate, breathable fabric. They have watertight seals at the neck, wrist, and ankles to keep the wearer dry and are designed so that one common size will fit most adults.

B.13. Use

When worn with a PFD and proper undergarments, a dry suit offers mobility and superior protection against the effects of wind, spray and cold water immersion.

WARNING

Dry suits alone provide inadequate insulation or hypothermic protection. Wear thermal underwear layered underneath the dry suit. Fully close the zipper prior to entering the water. Consult the *Coast Guard Rescue and Survival Systems Manual*, COMDTINST M10470.10 (series) for a complete list of undergarments.

B.14. Donning

Don a dry suit as described in the *Coast Guard Rescue and Survival Systems Manual*, COMDTINST M10470.10 (series). Multifilament polypropylene thermal underwear must be worn under the suit for proper protection against cold. By layering underwear, crew members achieve maximum protection from hypothermia under most conditions. A wearer may don this suit quickly and easily over regular clothing. Consequently, this suit is more bulky and loose fitting than a diver's wet suit. PFDs must also be worn because a dry suit has no inherent buoyancy. **A dry suit is not a PFD**. Surface swimmers wearing a dry suit may carry a distress signal light and a signal whistle tethered to the garment in lieu of the boat crew signal kit.

B.15. Entering the water Before entering the water, follow these three steps.

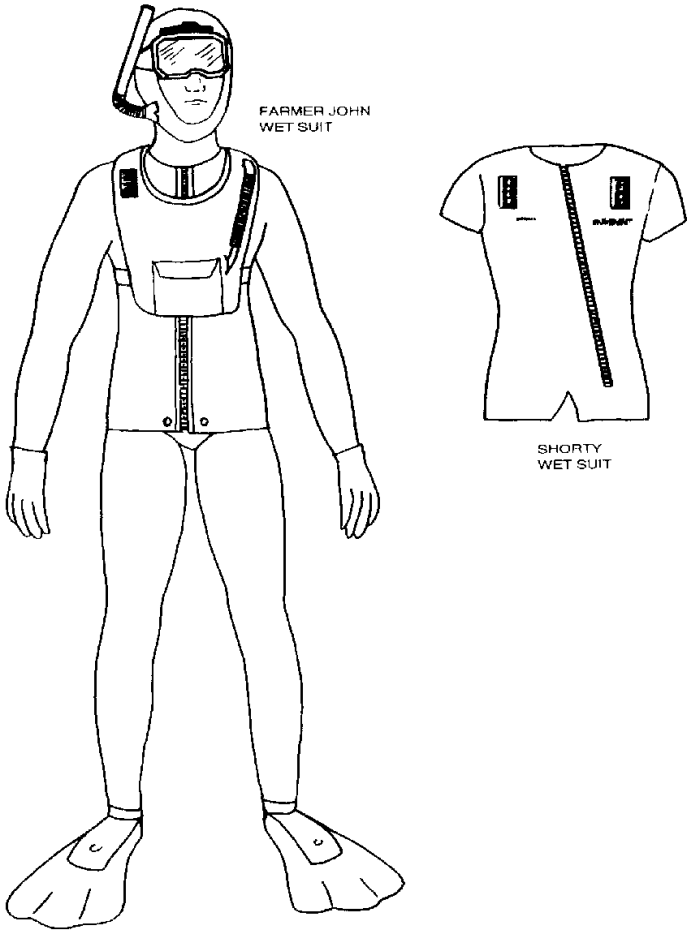
Step	Procedure
1	Slip on a wet suit hood.
2	Close all zippers and tighten all wrist and ankle straps.
3	Put on gloves.

Dry Suit
Figure 6-5

Wet Suit

B.16. General

The Wet suit may be worn by surface swimmers in the water. The wet suit is not authorized for use by boat crew members. It provides protection from exposure to cold water, but will not keep you dry. A dry suit or antiexposure coverall provides more out-of-water protection (see Figure 6-6).



Wet Suit (typical neoprene)
Figure 6-6

B.17. Characteristics

The standard wet suit is fabricated of 3/16" neoprene foam, an elastic material with high-flotation characteristics. The surface swimmer's wet suit ensemble consists of a custom fitted two piece farmer-john style wet suit, a custom fitted one piece shorty wet suit, hood, gloves and boots. Refer to the *Coast Guard Rescue and Survival Systems Manual*, COMDTINST M10470.10 (series) for procurement and inspection.

B.18. Use

Units should issue a wet suit to personnel designated as surface swimmers. It should be individually fitted. For added comfort and warmth, the suit may be worn over polypropylene cold weather underwear. Units shall issue custom-fitted wet suits as non-returnable items.

NOTE

Wet suits are not authorized for crew members operating boats. Surface swimmers may wear either a dry suit or a wet suit when in the water, depending on water temperature.

B.19. Donning

When properly worn and with all fasteners closed, a wet suit should fit almost skin-tight. Surface swimmers wearing a wet suit may carry a distress signal light and a signal whistle tethered to the garment in lieu of the boat crew signal kit.

B.20. Entering the water

To enter the water while wearing a wet suit, follow the instructions in paragraph A.5. above for PFDs.

Section C. Headgear

C.1. Thermal protection

The Navy standard wool watch cap is worn for thermal protection. However, under extreme weather conditions it offers little protection to the face and neck. When operating in a cold environment, the polypropylene or fleece balaclava should be worn in conjunction with the wool watch cap or protective helmet.

C.2. Protective helmet

The wearing of helmets on boats under hazardous conditions, such as heavy weather and helicopter operations, is mandatory for Coast Guard crews and strongly recommended for Auxiliarists. A light weight kayaker-type helmet is the best.

NOTE

The use of helmets by RHIB crews is recommended for all operations.

Section D. Boat Crew Signal Kit

Introduction

The equipment in a **Boat Crew Signal Kit** provides crew members a means to signal their position on the surface of the water, day or night. The Boat Crew Signal Kit shall be carried in the pockets and tethered to the PFD, mesh survival vest, or hypothermia protective device. The kit does not interfere with wearing a PFD or hypothermia protective clothing. Auxiliary survival equipment requirements are in the *Auxiliary Operations Policy Manual*, COMDTINST M16798.3 (series).

In this section

This section contains the following information.

Contents

D.1. Contents

Boat Crew Signal Kits contain the equipment listed here, with their use, characteristics, and operation described later in this section.

NOTE

The PML is not an authorized substitute for the Distress Signal Light.

Quantity	Equipment
1	Emergency Signaling Mirror
1	Signal Whistle
1	Marine Smoke and Illumination Signal
1	Illumination Signal Kit
1	Distress Signal Light

NOTE

A boat coxswain is responsible for ensuring that each boat crew member wears a PFD, vest, or hypothermia protective device containing all required items.

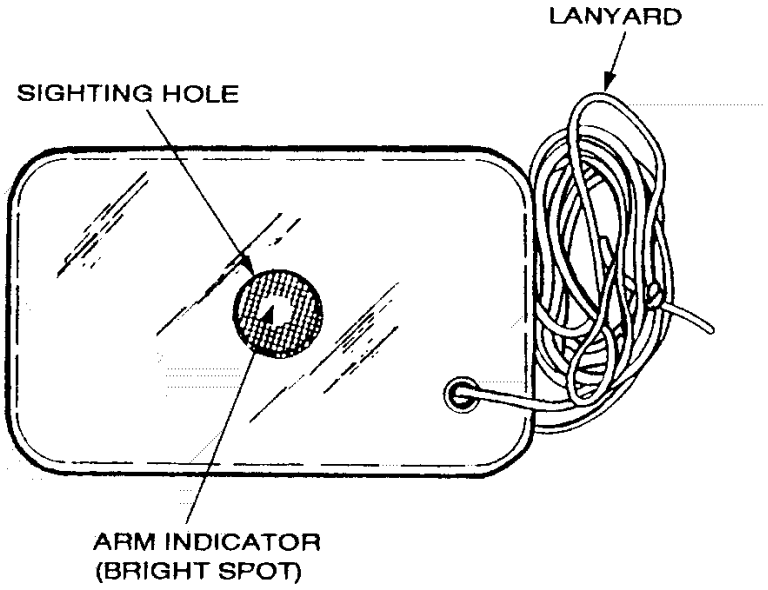
CAUTION !

To prevent losing signal kit equipment overboard while being handled, each item shall be tethered to the vest with a lanyard.

Emergency Signaling Mirror

D.2. General

The **emergency signaling mirror** is a pocket-sized mirror with a sighting hole in the center and a lanyard attached (see Figure 6-7). However, any common mirror is useful as an emergency signaling device.



Emergency Signaling Mirror, MK-3
Figure 6-7

D.3. Use

The mirror is used to attract the attention of passing aircraft, boats, or ground rescue teams by reflecting light at them.

D.4. Characteristics

Light reflected in this manner can be seen at a great distance from the point of origin. Practice is the key to effective use of a signal mirror.

D.5. Operation

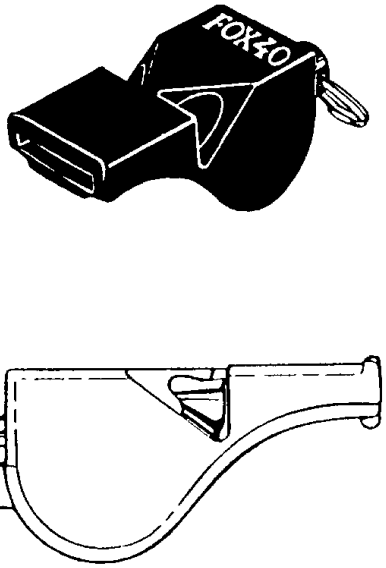
Instructions for using the mirror are printed on its back. The steps below describe how to properly use this accessory.

Step	Procedure
1	Face a point about halfway between the sun and an object you wish to signal.
2	Reflect sunlight from the mirror onto a nearby surface such as the raft, your hand, etc.
3	Slowly bring the mirror up to eye-level and look through the sighting hole. You will see a bright light spot, this is the aim indicator.
4	Hold the mirror near your eye and slowly turn and manipulate it so the bright light spot is on target.

Signal Whistle

D.6. General

The **whistle** is a small, hand-held device that produces a loud sound when you blow into it (see Figure 6-8). The standard whistle is constructed of plastic and resembles a police officer's whistle.



Signal Whistle
Figure 6-8

D.7. Use

The sound produced by a whistle will attract the attention of rescuers and guide them to your location. During periods of restricted visibility, fog, and darkness, the sound it produces may be heard by rescuers before they sight your distress signal light.

D.8. Characteristics

Depending on weather conditions, a whistle's audible sound may be heard up to 1,000 meters/1,100 yards. Any wind has the effect of carrying the sound downwind.

D.9. Operation

Place the reed part of a whistle between your lips and blow. If the whistle does not produce a distinct whistle-like tone, quickly turn the whistle over and blow the water out the bail air relief hole and try again.

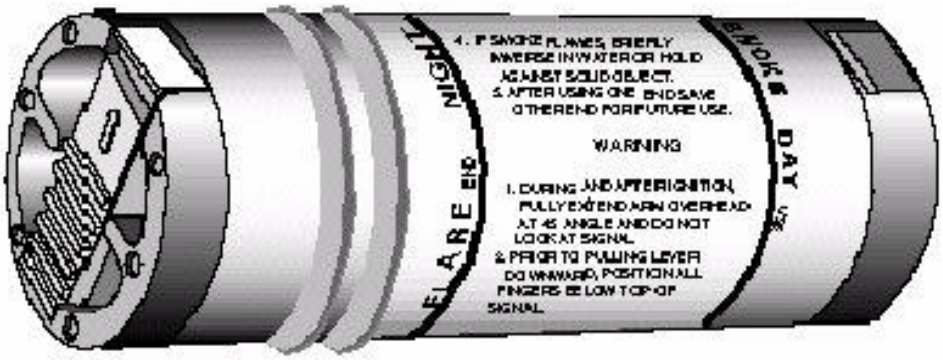
Smoke and Illumination Signal, MK-14 MOD 0

D.10. General

The MK-124 MOD 0 is a pyrotechnic smoke and illumination signal used day or night as a distress signal at sea or on land (see Figure 6-9). One end produces orange smoke as the day signal and the other end produces a red flare as the night signal. Because of its weight, about 8 ounces, and size, it may be carried in a PFD, vest, antiexposure coverall, or life raft.

NOTE

Auxiliary crew members may use commercially available Coast Guard approved survival equipment while operating an Auxiliary facility. See COMDTINST M16798.3 series for specific requirements.



Smoke and Illumination Signal, MK-124 MOD 0
Figure 6-9

D.11. Use

These signals are used to attract vessels, aircraft, and ground rescue teams daylight or nighttime. The signal may be used to indicate wind direction for helicopter hoists. It is labeled with the following operating instructions:

WARNING

Under no circumstances shall personnel ignite both ends at one time.

- Do not dispose of the signal until both ends have been used.
- **Only when signals misfire** should you dispose of them over the side. Misfires are a safety hazard if kept on board a vessel.
- When **both ends** of the signal have been discharged, properly dispose of it. In an actual distress situation, toss spent signals over the side.

D.12. Characteristics

As mentioned above, both ends of the device produce a signal and each end burns for about 20 seconds. The night end produces a RED FLARE (similar to a road flare) and the day end produces ORANGE SMOKE.

D.13. Operation

The device has two raised bands around its circumference on its night end (flare). These beads positively identify the night end by sense of touch. Also, a label on the case identifies the day (smoke) and night (flare) ends and provides instructions for use.

After choosing which end to use, follow the operating instructions:

Step	Procedure
1	Remove the black rubber protective cap from the end to be ignited.
2	Slide the plastic lever in the direction of the arrow until fully extended.
3	Hold the signal downwind and overhead at a 45° angle from the horizon over the side of the raft or away from dry debris to prevent burns from hot drippings.
4	Using your thumb, pull down on the extended tab to ignite signal. See Figure 6-10.
5	If the smoke signal end flames up, briefly immerse it in water or hold it against a solid object.
6	After using one end, douse in water to cool it, or if on land place it on the ground to cool. Save the signal to use the other end when needed

WARNING

Prior to pulling lever downward, position all fingers below top of signal.

WARNING

Do not direct either end of a signal toward another person.

WARNING

After ignition, the outer case may overheat and burn the hand. Dropping the signal on land will not decrease its effectiveness.

WARNING

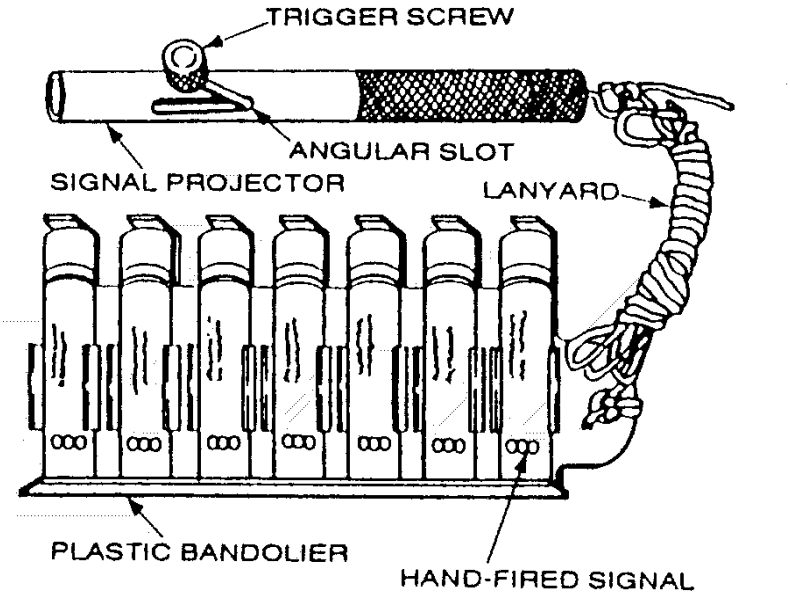
Do not look directly at the light of a night flare close up. The intensity of the lights could burn your eyes.

Operating the MK-124 MOD 0 Signal Flare
Figure 6-10

Illumination Signal Kit, MK-79 MOD 0

D.14. General

The Illumination Signal Kit, MK-79 is a pyrotechnic that contains seven screw-in cartridge flares and one pencil type projector. The projector in this kit is used to aim and fire a signal cartridge (see Figure 6-11).



Illumination Signal Kit, MK-79 MOD 0
Figure 6-11

D.15. Use

The Illumination Signal Kit, MK-79 is used to attract vessels, aircraft, and ground rescue teams.

D.16. Characteristics

These signals produce a red star display at an altitude of 250-650 feet for a minimum time of 4.5 seconds. Their luminous intensity is about 12,000 candle power.

D.17. Operation

The following are steps for operating the MK-79.

WARNING

Failing to cock the firing pin back may result in the cartridge firing prematurely when attaching to the projector.

Step	Procedure
1	Remove the bandolier and projector from the plastic envelope.
2	Cock the firing pin of the projector by moving the trigger screw to the bottom of the vertical slot and slipping it to the right so that it catches at the top of the angular (safety) slot.
3	Bend protective plastic tab away from signal in bandolier to allow attachment to projector.

WARNING

The plastic tabs over signals in the bandolier protect percussion primers on the cartridges from being struck accidentally. They should be kept intact until just before loading into the projector.

WARNING

Keep the projectile-end of the flare pointed in a safe direction while loading the flare in the projector. Ensure Step 2 is completed prior to "loading" - accidental firing may occur if projector is not cocked.

4	Mate a signal flare with the projector and rotate clockwise until signal is seated.
5	Hold projector overhead with arm fully extended. The projector should be pointed at a slight angle away from the body.
6	While firmly gripping the projector, fire the signal by slipping the trigger screw to the left out of the safety slot and into the firing slot.
7	If the signal fails to fire, try again twice by depressing the trigger screw to the bottom of the firing slot with the thumb and releasing it quickly. If it still fails to fire, wait 30 seconds before unscrewing, to eliminate possibility of hang fire.

NOTE

This action should be one continuous movement so that your thumb does not interfere with the upward motion of the trigger screw when it is brought into the firing slot. The trigger screw must "snap" upward.

WARNING

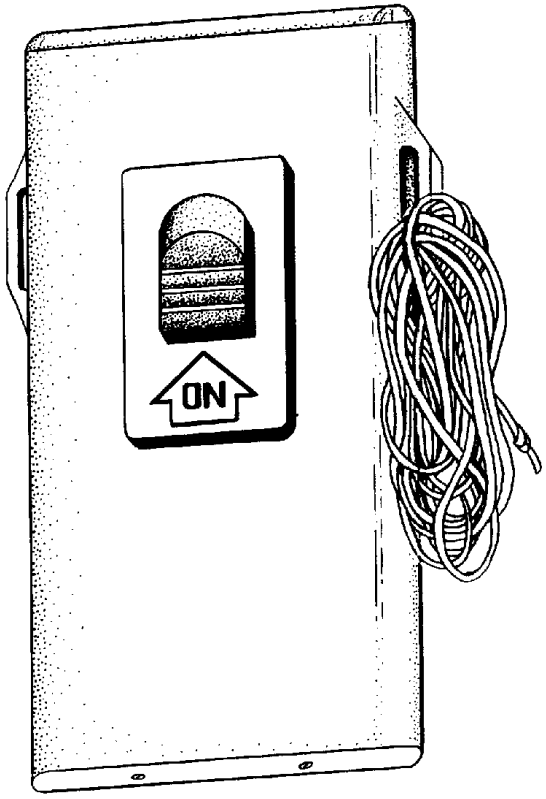
Do not aim at aircraft or other objects.

8	Unscrew the spent signal case or signal that has failed to fire. Discard by throwing overboard.
9	To fire another signal, repeat the steps above.

Distress Signal Light

D.18. General

The **Distress Signal Light** is a lightweight, compact, battery-operated strobe light that emits a high intensity visual distress signal (see Figure 6-12). The strobe light model that is currently in use is the battery operated SDU-5/E or CG-1 Strobe Light. Some lights are also Coast Guard approved as PMLs



Distress Signal Light, CG-1
Figure 6-12

D.19. Use

This light is used to attract the attention of aircraft, ships, or ground parties. It is sold on the market as a rescue/anti-collision light. Crew members carry the distress signal light in a pocket, or attach it to a line or belt. Keep it tethered to a garment that you are wearing.

D.20. Characteristics

The SDU-5/E and the CG-1 distress signal lights emit approximately 50 flashes per minute. At the peak of each flash, the luminous intensity is 100,000 candlepower. Under continuous operation it will flash for 9 hours, or 18 hours when operated intermittently. On a clear night, the Distress Signal Light has a minimum visual range of five miles. However, the range of visibility will be determined by the height of eye of the observer. For an observer low on a boat, the range will most likely be much less than the advertised five miles.

D.21. Operation

The following are the steps to operate the Distress Signal Light.

Step	Procedure
1	Turn ON. Push the switch in until a click is heard, then release. Light should begin flashing within seconds.
2	Turn OFF. Push the switch in until click is heard, then release. The light should stop flashing.
3	If you test this light and it fails to perform within operational limits, replace the battery. If it still does not operate properly, remove it from service.

Section E. Personnel Survival Kit

E.1. General

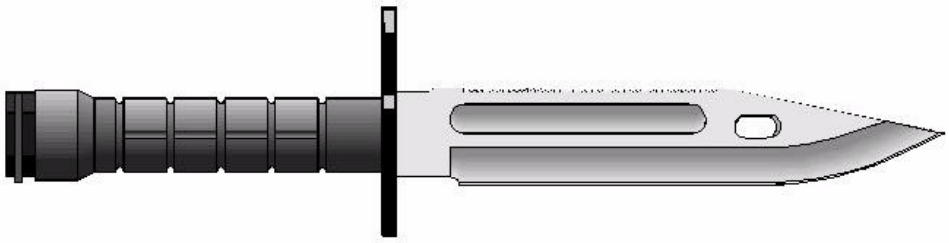
As part of the boat outfit list, the Coast Guard requires a personnel survival kit to help the crew survive in hazardous situations, such as when a boat capsizes or sinks, or someone is lost overboard. The kit should be in a watertight bag that is readily available in an emergency. It includes the boat crew signal kit (discussed earlier) and the following individual survival items.

- Survival Knife
- Boat Crew Signal Kit
- Visual Distress Signals

These components may also be carried or worn by the crew members. Auxiliarists may build a kit with regular marine store merchandise

E.2. Survival knife

The survival knife is the basic tool used to free yourself from entangling lines. It is also used to cut material blocking a path in escaping a capsized or sinking boat. The selection of a knife is critical; your life may depend upon it. Folding knives (which may be issued by the unit to each crew member) are convenient to carry, but may be impossible to open with gloves or with loss of fingers use due to a cold environment. Folding knives may also lack the blade strength required in an emergency. A knife designed for water use such as a diver's knife is the best choice for a survival knife. It should be double edged, corrosion resistant, and checked periodically for sharpness (Figure 6-13).



Survival Knife
Figure 6-13

E.3. Boat crew signal kit

The boat crew signal kit was discussed earlier in this Chapter. Individual items were listed along with their use, characteristics, and operation.

E.4. Visual distress signals

Visual distress signals include pyrotechnics and other visual signals that may be displayed by any vessel. Pyrotechnics are discussed in a following section, and distress signals in general are discussed in Chapter 11, *Communications*. Unit commanders will outfit boats with the required visual distress signaling devices. All Auxiliary boats must carry visual distress signaling devices that meet facility requirements.

Section F. Pyrotechnics

F.1. General

If the boat becomes disabled during a mission, its crew must have some means of signaling aircraft or vessels for assistance. Signaling devices include **pyrotechnics**. The Smoke and Illumination Signal, Marine MK-124, MOD 0 and the MK 79, MOD 0 Signal Kit were discussed earlier in this chapter under the boat crew signal kit. Additional information is provided below. Visual distress signals in general are discussed in Chapter 11, *Communications.*

F.2. Requirements

Stowage and handling of pyrotechnics is done in accordance with *the Coast Guard Ordnance Manual*, COMDTINST M8000.2 (series) and the Navy publication NAVSEA SW050-AB-MMA-010. Coast Guard unit commanders will outfit their boats with the required pyrotechnics. All Auxiliary boats must carry visual distress signals that meet facility requirements. The pyrotechnic devices carried as part of their personnel survival kit should be small enough to be carried comfortably and be well protected from the elements. The following are Coast Guard approved visual distress signal devices typically used by the Auxiliary.

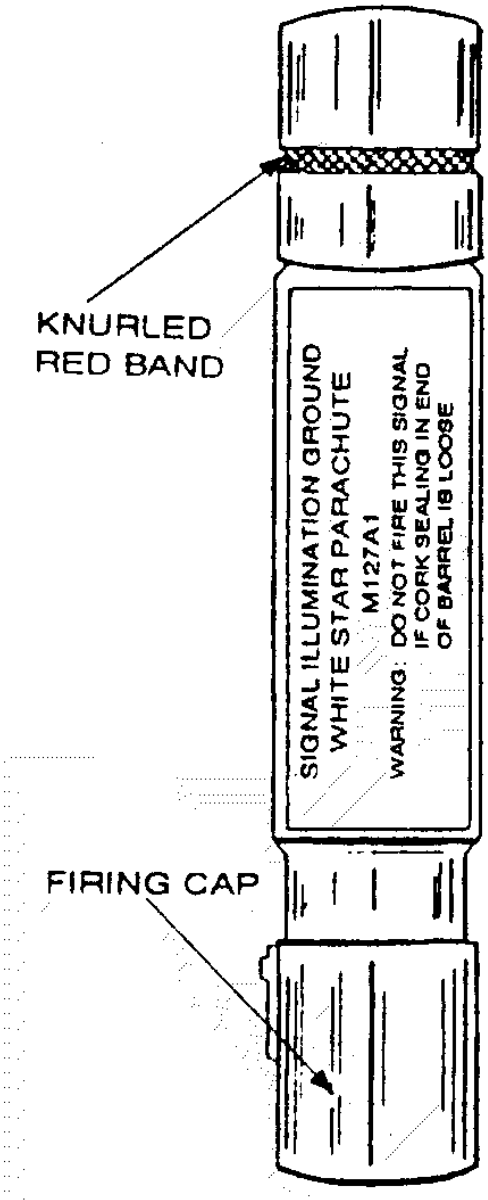
NOTE

Pyrotechnic devices should not be used until a rescue craft is actually in sight.

CFR No. Marked on Device	Device Description	Quantity
160.021	Hand-held red flare distress signals, day and night.	3
160.022	Floating orange smoke distress signals, day only	3
160.024	Pistol-projected parachute red flare distress signals, day and night	3
160.037	Hand-held orange smoke distress signals, day only	3
160.057	Floating orange smoke distress signals, day only	3
160.066	Distress signal for boats, red aerial pyrotechnic flare, day and night	3

F.3. Parachute illumination signal, MK-127A1

The Parachute Illumination Signal, MK-127A1 is a nighttime illumination signaling device. When fired, it climbs to an altitude of 650 to 700 feet before igniting. Upon ignition, it produces a parachute-suspended white star flare that burns for about 36 seconds with 125,000 candlepower. The signal descends at a rate of 10 to 15 feet per second (see Figure 6-14).



Parachute Illumination Signal, MK-127A1
Figure 6-14

F.3.a. Firing instructions

The procedures for firing the parachute illumination signal are described below.

Step	Procedure
1	Do not remove a signal from its sealed container until just before use.
2	Remove a signal from the container in accordance with instructions printed on the container.
3	In all handling, avoid striking the signal primer.
4	Do not use signals that are dented, cracked, or otherwise damaged.
5	Hold the signal in your left hand with the RED band of the signal FACING UP. Align your left thumb and forefinger along the red band.
6	Withdraw the firing cap from the lower end of the signal.
7	Point the ejection end of the signal (the end opposite the red knurled band) away from the body and away from other people, equipment, and materials. Slowly push the cap onto the primer (red band) end until the cap meets the edge of the knurled band. DO NOT PERMIT THE CAP TO GO BEYOND THE RED BAND.
8	Hold the signal FIRMLY at arm's length with the left hand, with the ejection end facing straight up. The signal should be held in a vertical position (90° elevation) when firing.
9	Strike the firing cap bottom sharply with the palm of the right hand, keeping the left arm rigid and pointing straight up.
10	If a signal misfires while on land, place it in a secure position to prevent people from being hurt should the signal fire. The signal must not be approached for at least 30 minutes. If a misfire occurs while underway, toss it overboard.

CAUTION !

Exercise due care to prevent the expended rocket body from falling on people, water craft, and structures.

F.3.b. Firing angles

Firing a signal at angles other than a vertical position may be necessary under the following circumstances:

- To compensate for high wind velocities
- To place the signal display in a better position to be seen by searching aircraft

WARNING

If a signal is fired at an angle less than 90° elevation (directly overhead), the altitude reached is reduced and the altitude of candle burnout is lessened. If the firing angle is 60° or less, the candle will, in almost all cases, still be burning when it strikes the surface.

WARNING

When conducting SAR operations with a helicopter, extreme caution and coordination must be used by surface units using pyrotechnics. Do not fire pyrotechnics without permission and instructions from the aircraft commander.

Section G. Rescue and Survival Raft

G.1. General

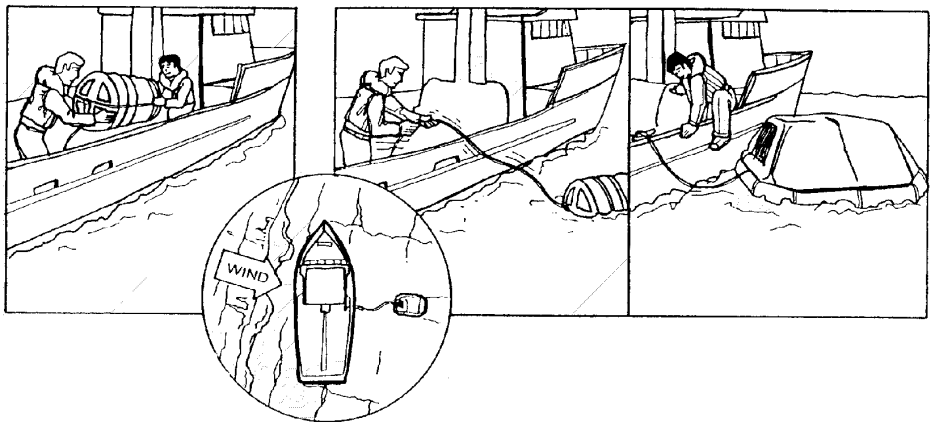
The six person rescue and survival raft is a multipurpose raft designed for crew survival or rescue and assistance to persons in distress. It is usually carried on Coast Guard boats greater than 30 feet long. The discussion here applies to a Coast Guard procured raft but the general procedures apply to almost any commercially available raft. The Auxiliary may use commercially available Coast Guard approved life rafts which may typically be less complete but still serve the same purpose. The instructions for use and maintenance of any life raft should always be reviewed.

G.2. Automatic inflation and deployment

When properly stowed, this life raft is designed to automatically float free from it's storage rack and inflate in the event of capsizing or sinking. As the raft container is released and drifts away, the inflation cable, attached to the raft-end of the 50-foot painter line is pulled tight. When this occurs, the CO_2 cylinder will automatically discharge and inflate the life raft. The painter line will remain attached to the rack by a weak link which requires 500 pounds of force to separate . Separation will also occur by heaving around on the painter line or by the stress exerted on it from the raft's buoyancy if the boat sinks to a depth greater than 50 feet.

G.3. Manual deployment

To manually deploy the rescue and survival raft, do the following steps (see Figure 6-15).



Manual Deployment of Survival Raft
Figure 6-15

Step	Procedure
1	Remove the raft container from its storage rack and remove the stainless steel bands from the raft box.
2	Place the raft container in the water on the leeward side of the boat.
3	Completely pull the 50-foot painter line from the raft container. This will inflate the raft.
4	If practical, pull the raft alongside the boat and board the raft directly from the boat.
5	If time permits, take extra survival equipment and supplies aboard the raft. Such equipment may include illumination signals, portable radios, food, water, first aid supplies, and fishing gear.
6	Untie the canopy and pull it over the support tube. Then re-tie it in the closed position.

WARNING

The painter line will only be secured to the boat by the weak link. Attaching the painter line directly to the boat could jeopardize proper deployment of the raft, especially in water with a depth greater than 50 feet.

CAUTION !

If possible, board the raft directly from the sinking vessel, avoid entering the water.

G.4. Boarding a raft

Try to remain in the general area of the boat. If the boat does not sink immediately, leave the operating painter line attached to the raft storage rack on the boat. If the boat sinks rapidly, cut the painter line before it breaks (at the weak link) under the strain caused when the boat goes under.

G.5. Tasks on board a raft

Upon boarding a raft, complete the following tasks as soon as possible:

Step	Procedure
1	Account for everyone and search for survivors.
2	If more than one raft is deployed, tie them together.
3	Check the physical condition of all people aboard. Give first-aid as necessary. Weather permitting, wash any oil or gasoline from your clothing and body. These substances will not only burn your skin, but also pose a fire hazard. Additionally, they may be transferred from your skin to the raft, deteriorating the rubber surfaces.
4	Salvage any floating equipment which may be useful. Inventory, stow, and secure all survival items.
5	To provide stability in moderate to heavy sea, life rafts on Coast Guard boats automatically deploy a sea anchor upon inflation.
6	Check the raft for proper inflation and points of possible chafing (areas where equipment may wear a hole in the buoyancy tubes).
7	Bail out any water that may have entered the raft.
8	Inflate the floor immediately.
9	In cold water, put on hypothermia protective clothing, if available. Rig the entrance cover, close when necessary.
10	If other people are with you, huddle together for warmth.

CAUTION !

Be careful not to snag the raft with your shoes or with sharp objects.

G.6. Conduct in a raft

The safety and survival of everyone in a raft depends on clear thinking and common sense. To protect those aboard and increase survival time, take the following steps:

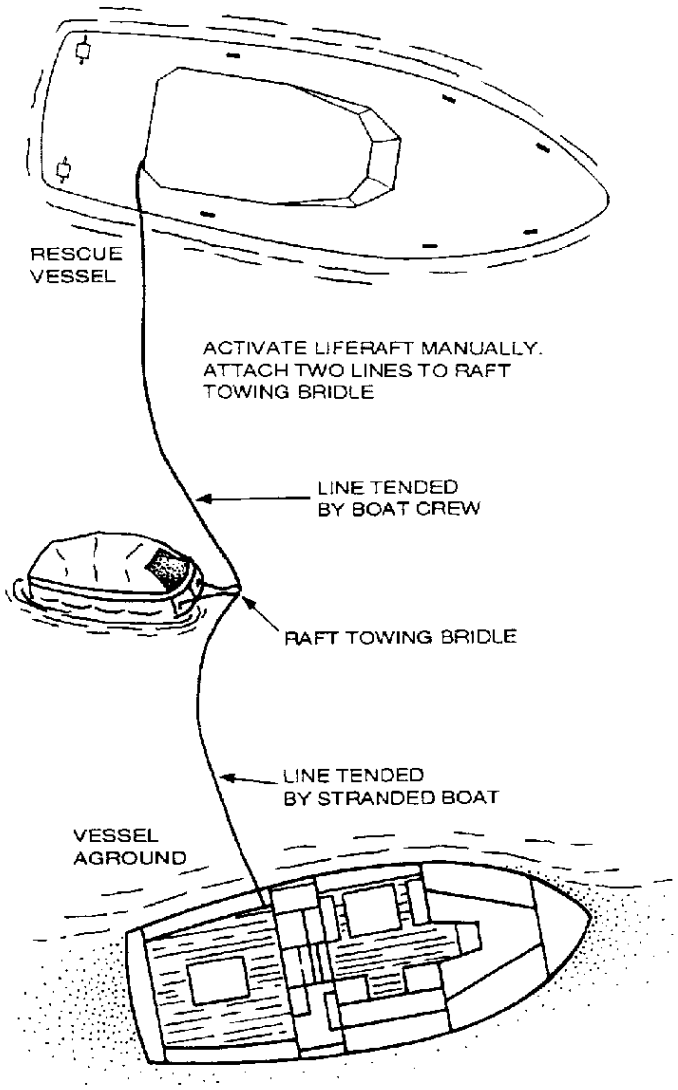
Step	Procedure
1	Maintain a positive attitude.
2	Inventory <u>all</u> equipment. Ration water and food. Assign lookout and other necessary duties to crew members.
3	DO NOT rely on memory. KEEP A WRITTEN LOG. Record the time of entry into the water, names and physical condition of survivors, ration schedule, winds, weather, direction of swells, times of sunrise and sunset and other navigation data.

G.7. Using a raft to rescue others

When it is impossible or too dangerous to maneuver close to a distressed vessel, the life raft may be used to ferry survivors to your boat. It may also be used to recover people from the water if you cannot get a boat close enough to them. Use the following procedures when deploying a life raft during a rescue attempt (see Figure 6-16).

WARNING

Although the raft is ballasted and very stable in most sea states, it may capsize in large breaking waves. For this reason, consider other methods for rescue of people in breaking surf or seas. (e.g., helicopter rescue).



Life Raft as Rescue Ferry
Figure 6-16

Step	Procedure
1	Remove the raft container from its storage rack
2	Do not manually or automatically inflate the life raft as you remove the tape sealing the life raft case (half shells) together
3	Roll the life raft out of the case and place it in the water on the leeward side of the boat
4	Pull the 50’ painter line from the raft container, manually inflate the raft, and hold it alongside your boat
5	Attach two lines, each of a length longer than the maximum distance between your boat and the people in distress.
6	Use one line to tend the life raft from your boat during the evolution (NEVER LET GO OF THIS LINE)
7	Pass the other line to the people in distress with a heaving line or let the current float it down to them
8	Tell the persons being assisted to haul the life raft to their position
9	Once the life raft is alongside, direct the persons to board the life raft, one person at a time.
10	If the number of people being assisted is more than the carrying capacity of the raft, direct the people remaining to tend the line attached to the life raft from their location; haul back the maximum number of survivors and repeat the procedure.
11	After recovering all people, deflate the raft and bring it aboard the rescue boat. The raft may have taken on water during the rescue evolution. De-ballast the raft before bringing it aboard. Use the handles located on the ballast bags and slowly lift one side of the raft until all the water has run out.
12	Once the raft is aboard, do not repack the raft. Wash the raft and have it repacked at a certified packing station before returning it to service.

WARNING

Ensure each person is wearing a PFD. Do not permit more people to enter the raft than is allowed by the raft’s specifications.

Section H. Emergency Procedures in the Event of Capsizing

H.1. General

The key to surviving a capsize is to avoid it ever happening. If it can not be avoided, then the crew must recognize when it could happen and be prepared. Chapter 9, *Stability*, Chapter 10, *Boat Handling*, and the *Heavy Weather Addendum*, all discuss situations and conditions where capsizing could result. These chapters also present warning signs and measures to take to minimize risk. The coxswain must continually assess the conditions to ensure the safety of the boat crew and of those in distress; however, all crew members have the responsibility to keep the coxswain advised if the situation changes.

H.2. Prevention

A boat is less likely to capsize in deep, open water. The chances of capsizing are greatest while operating in or near the surf or breaking seas. The force needed to capsize is most likely to come from heavy seas directly astern (following seas), or large breakers striking abeam. Stay at sea until conditions change. The safest point for most boats to take heavy seas is nearly bow-on. Do not operate or tow in conditions beyond the capability of the boat or crew. In such conditions, advise the operational commander so that the proper resource (e.g., MLB, SRB, cutter, or helicopter) can respond. Conditions present in many capsizings included:

- Surf or breaking seas
- Shallow water depth (less than 20 feet)
- Going against a strong tidal current and with steep following seas
- Escorting or towing another boat through an inlet
- Restricted visibility due to darkness, rain, or fog
- Stability reduced by low fuel in the tank, excessive amounts of water in bilges, icing of topsides, or too many people on board

H.3. Precautions

If the hull is intact after capsizing, it will not sink for some time, even in rough seas. The crew will have time to escape if panic is avoided. Precautions ahead of time include:

- Learn the boat's interior. Initially the crew will be disoriented due to being upside down and with a lack of lighting.
- Stow all loose gear and have all equipment and doors operating properly for ease in escaping.
- Know the location and use of all survival equipment. Check it regularly to be sure that it is adequate, in good repair, and that all signaling devices work.
- Be ready to grab a sturdy support to prevent being thrown about.

H.4. Escape procedures

If trapped in or under the boat, seek out an air pocket near the top (inverted bottom). Gather the crew together in the air pocket. Take time to have everyone settle down and focus on planning a safe escape. Discuss the escape route and objects of reference along the route. Look down; light may be visible and escape immediate.

- Make every effort to escape. The boat may sink or the air will eventually escape through hull fittings, cracks, or holes, or become unfit to breathe (fuel vapors, bilge waste, or lack of oxygen due to survivors breathing).
- Before attempting to escape, check for needed survival equipment, especially flotation and signaling devices.
- PFDs may have to be removed temporarily for people to fit through spaces or to go underwater to reach an exit. If necessary, tie a line to the PFD and pull it out after exiting.
- Avoid the stern if the engines are still running.
- If caught in an open cockpit area, swim down below the gunwales and surface alongside the boat.

H.4.a. Escape from an enclosed compartment

Escape from an enclosed compartment will require additional planning. Advice includes:

- All exits are upside down when the boat capsizes. Locate an exit route and reference points from the compartment to open water.
- PFDs may have to be removed temporarily for people to fit through spaces or to go underwater to reach an exit. If necessary, tie a line to the PFD and pull it out after exiting.
- Swim underwater through the exit and out from the boat. If a line is available, the best swimmer should exit first through a cabin door or window, carrying the line. If no line is available, have the best swimmer go first, followed by a poorer swimmer and lastly a good swimmer. (If the poorer swimmers are left alone inside, they are likely to panic and not escape.) The first swimmer, when free, should tap on the hull to signal success in getting out to the others.
- Cold water decreases the length of time anyone can hold their breath underwater. Immersion in cold water may also give a sensation of tightness in the chest. Experiment inside the compartment before attempting to escape. This will decrease the possibility of panic during the escape attempt.

H.4.b. Alongside a capsized boat

Survivors from a capsized boat should attempt to stay with the boat or other visible floating debris.

- Get onboard a life raft if available.
- If a life raft is not available, climb onto the boat, if possible. Otherwise, hold onto the largest floating object available.
- Generally, everyone should stay with the boat and not swim for shore. Distances to the beach can be deceiving and strenuous activities such as swimming in cold water can hasten the onset of hypothermia.

Survivors should consider tying themselves to the boat if there is a rapid means of untying or cutting free, in case the boat shifts or sinks. Most people are likely to become tired or develop hypothermia.

H.4.c. Remaining inside a capsized boat

If someone cannot exit the capsized boat:

- Remain calm and stay within an air pocket.
- Trap the air in the compartments (e.g., close any hull valves that can be located).
- When hearing rescuers, attempt to communicate to them by shouting or tapping on the hull.
- Conserve oxygen by remaining calm and minimizing physical activity. If possible, get out of the water to reduce hypothermia.
- Remember that rescuers should arrive soon.